

Firstly, research for design has perhaps the longest tradition, for example in engineering, product or industrial design, computer science, and informatics, where investigations of materials, mechanics and function have long informed design. This tradition dates back to inspirations from scientific design and Le Corbusier's ideas of 'modern architectural science' (de Vries et al. 1992: 20). This form of research for design is especially strong in Design Science, which appeared as part of 1960s attempts to build systematic knowledge applicable to design. Simon's classic work *The Sciences of the Artificial* (2006, 3edn.) is central to this tradition, which is represented in this book by Pries-Heje and Baskerville in chapter 5. Across several disciplines and application fields, Design Science seeks to provide universal models for rational responses to specific design situations. The relationship is usually instrumental and only loosely connected with reflection on how research works in designing. More qualitative approaches that cut across other forms of design research are found in ethnographically informed design, for example in Computer Supported Cooperative Work (Randall et al. 2007).

Secondly, Cross argued that the 1980s and 1990s opened up interesting avenues of research *into* design, with approaches that he later labelled as 'science of design', studying how design processes work (Cross 2006: 98f.). This trend has continued, shifted and expanded to include new theoretical resources such as phenomenology and actor network theory, and several chapters in this book contribute to this field, for example Binder and Nickelsen in chapter 3, Olsen and Heaton in chapter 6, and Lindström in chapter 8.

A separation between design and research is characteristic for the more 'scientific' types of this approach. While research *for* design is functionalist in the way that research is seen to provide knowledge, models and input for designers, in research *into* design, researchers study, describe and analyse how design is done. In both approaches research and design, researchers and designers are held apart, although studies of design practice may inform research for design, and we can imagine a bi-directional move across and between the two forms of design research.

However, in the third kind of design research we discuss in this book, design and research cannot be kept separate. Research works *through* design and design works *through* research. This is, for example, the case in chapter 2 by Simonsen and Hertzum and chapter 10 by Ingemann. Research and design come together, and this becomes central to contemporary design challenges and opportunities, as we will argue below with reference to, among others, Schön's (1983, 1987) influential work on the reflective practitioner, Buchanan's (2001) design revolution, Cross' (2006) designerly ways of knowing, and Nowotny et al.'s (2001) observation of the growing integration of the social, the material and the scientific in 'mode 2' (knowledge) production. Design-based research is about the complex and multi-directional integrations of research and design, where design becomes as much a medium and process of research, as a result. We argue that this move carries inspiration and implications for both the critical enquiry *into* design and the ambitions of making a difference with research *for* design.

HOW DESIGN RESEARCH TAKES PLACE

Design draws together actors who want to change something or create something new. Attractive and wished-for effects are sought; aesthetic experiences in art, architecture, music, design, performance, a new product that satisfies new needs or desires, a new material or technology that alleviates dull or difficult tasks or makes something new possible, a new service or process, a reduction in people's environmental foot prints, higher quality, reduced costs, heightened employee or customer satisfaction, pleasure in experience – the list is endless. Some science and research-based knowledge about how to obtain such results is available but how this knowledge is folded into design effectively, and how it can be synchronized with everyday innovative practice is often unclear.

With this book we would like to contribute to efforts of taking design beyond Design (the creative genius kind). What scholars and practitioners refer to as design facilitation (Buchanan 2001, Thackara 2005) informs our exploration. But we wish to show how designers and researchers are practically going beyond traditions, mobilize different scientific disciplines and address extremely complex design challenges in different contexts in and through idiosyncratic combinations of design and research. The book looks for common characteristics of design processes across disciplines and for how different design perspectives and practices cross-fertilize each other, devising design processes to pursue wished-for effects and outcomes. The book studies examples of how analytical and prescriptive approaches can inform each other.

Our focus is on how interdisciplinary scientific knowledge is put into practice in ways that are helpful for practitioners and others and that make extra-ordinary results possible. Our *objective* is to explore common aspects that characterize a diversity of relations between research and design. Our focus on research through design and design through research raises questions of how design and research practices are integrated and feed each other. This form of design research shapes up as 'mode 2 design'. Nowotny (2004) observes an ever deeper integration of knowledge and society, where research 'is increasingly carried out in the context of application, that is, problems are formulated from the very beginning within a dialogue among a large number of different actors and their perspectives'. Building on this, mode 2 design research acknowledges that research, design and society are heavily integrated, since research contributes to assembling society and society is a constant field of testing and experimenting in research and design.

A central point of the book is to focus on the *processes* involved in doing design. Another central point is that designs emerging from analysis of the *contexts* for design use are much more likely to be successful and of lasting value. Although some designs arises 'out of the blue', research into the various aspects of context for a design-in-the-making are a common starting point. From the analyses of processes and contexts in this book, we learn about the various ways in which research is increasingly being used in the field and how this works in practice in a society where science is deeply

embedded (Novotny et al. 2001). However, as we will explain further later in this chapter, we do not want to overstate novelty and innovation; creativity in designing clearly also involves improvisation beyond great plans and outlines, in making ‘things right’ in the day-to-day (Hallam and Ingold 2007). Our approach thus refers to reflexivity-in-action (Schön 1983, 1987), and through studies of how designs emerge through experimenting in dynamic contexts, our focus leads to a consideration of design research approaches that are socially robust by appreciating the realities of contexts of design and research.

EMERGING DESIGN RESEARCH

‘Design research’ has been developing for many years. One proponent of its revolutionary potentials is Richard Buchanan (2001). Looking back at the history of design since the Renaissance, where design became second to science, he suggests that the 20th century brought a new agenda for design research. Design research takes design beyond its focus on the visual and form, e.g. in graphic design or industrial design, and into academia and interdisciplinary collaborations, now including interaction design, service design and environmental design (ibid.: 11). Design knowledge today is of another kind than traditional scientific knowledge, it is practical and scientific, and it works through synergies. Another central figure in design research is Nigel Cross. In his book *Designerly Ways of Knowing* (2006) he introduces explanations of how design research differs from the kinds of knowledge derived from both (natural) science and humanities. Design is about ‘the artificial world’ and its value is ‘practicality, ingenuity, empathy, and a concern for “appropriateness”’ (ibid.: 2). Design research is thus about problem solutions, and this ‘way of knowing’ has common features across and beyond specific applied fields and professions. Designerly practice involves envisioning and trying out solutions, it requires science, but also intuition, emotion and aesthetic judgement. Thereby designers’ knowledge is constructive with pragmatic abduction, reaching beyond debates over induction versus deduction in science.

To the authors in this book, many of whom have a grounding in the social sciences, the humanities, informatics and engineering, Cross’ way of carving space out for design research between science and humanities reminds of the 20th century fight for a place for social science in-between the ‘two cultures’ of natural science and humanities, (Snow 1959) which was firmly described in the *Report of the Gulbenkian Commission on the Restructuring of the Social Sciences* (Wallerstein et al. 1996). This report argued for opening up the social sciences. Design research, too, aims at interdisciplinary research across the faculties of natural science, humanities and social science. Design research is thus closely related to the kinds of social science which is practically engaged in societies as proposed in *Making Social Sciences Matter* (Flyvbjerg 2001) or public sociology (Burawoy 2005). Buchanan (2001: 20-22) in his example of case studies in design research also points to important inspirations from and synergies with social science methodologies.

However, unlike social science, design research was never in a situation where it had to argue that design matters. Design research had to defend why it was research, rather